Comment on "Froissart bound on total cross section without unknown constants" by A. Martin and S.M. Roy

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Here I explain why critics of my work in the above paper is inadequate.

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The recent paper [1] criticized my earlier publication [2]. Regretfully, presentation of my work by Martin and Roy looks to be incorrect. Therefore, it is necessary to clarify the situation.

1. According to Martin and Roy [1], Sec. 2 of my paper "is similar to the 1962 and 1963 works of Martin" [3, 4]. The talk [3] gives only a brief presentation of results of the much more detailed paper [4]. The approach used by the both publications is definitely different from mine [2]. Martin studies there only the imaginary part of the scattering amplitude. As a result, he could derive a bound for the total cross section (through the optical theorem), but not for differential cross sections. Contrary to that, I followed to Froissart [5] and have not separated the real and imaginary parts, which allowed me (again, following to Froissart) to constrain both total and differential cross sections.

My approach is, in essence, very similar to Froissart's one. They differ mainly in the manner of using assumptions on the asymptotic behavior of the amplitude at the large circles of the energy and momentum transfer. Froissart assumes them to provide dispersion relations in energy and momentum transfer, with a finite number of subtractions. On the other side, I do not need any dispersion relations at all and is able to use high energy asymptotics of the amplitude as a separate arbitrary assumption which admit variations. This allows to analyze role of various assumptions. More detailed discussion of similarity and difference between these two approaches can be found in Ref.[2].

In any case, my paper [2] is not "similar to the 1962 and 1963 works of Martin" [3, 4].

2. In his various publications, starting from the papers [6], Martin has used axiomatics of local field theory. In Introduction to my paper [2], I noted that QCD might appear not corresponding to such axiomatics, since quarks and/or gluons do not have asymptotic states, while hadrons are not local objects (they consist of quarks and have, therefore, internal structure). Now, Martin and Roy [1] oppose this note, referring to Zimmermann [7], who "has shown that local fields can be associated to composite particles (for instance, deuterons)". This is true, of course, but a field theory expressed trough such local fields may look non-local. For instance, interactions of deuterons should reveal their form factors. Similarly, QCD may (and, most probably, should) appear non-local, being expressed in terms of hadron fields.

Curiously enough, Martin and Roy really support and even expand my note. Indeed, just after opposing it and reminding of Zimmermann's results, they write: "We postulate that this construction applies to hadrons made of quarks. This is not obvious because, in spite of the practical successes of QCD, nobody knows how to incorporate particles without asymptotic fields in a field theory." Thus, they clearly agree that applicability of Martin's assumptions to QCD, and to hadron physics, is not evident and needs indeed to be specially postulated.

3. As an additional point, Martin and Roy say that they "do not use the Froissart-Gribov representation of physical region partial waves for fixed s." I should emphasize here, that my approach does not use this representation as well.

In conclusion, this analysis shows that critics of my paper [2] by Martin and Roy [1] is inadequate.

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